

SPECIAL ISSUE EDITORIAL:

Virtual, Augmented and Mixed: New Realities in Construction

PUBLISHED: December 2019

EDITORS: Dermott McMeel & Vicente A. Gonzalez

DOI: [10.36680/j.itcon.2019.SI.VMAR](https://doi.org/10.36680/j.itcon.2019.SI.VMAR)

This special edition of Information Technology in Construction is focuses on new realities in construction. The editors have curated a series of papers intended to provoke speculation on the potential future of construction in the 21st Century and beyond. This edition grew from ConVR 2018: Evolving Construction, a conference held in Auckland, New Zealand. Where researchers reported on ideas, innovations and applications for virtual and augmented reality for construction. Authors of excellent papers were invited to extend their submission for publication in this special edition. Thus, this issue presents a glimpse into the state of research focused on construction and specifically the topic of ‘virtual and augmented reality’ in its broadest sense.

The Architecture, Engineering and Construction (AEC) sector is age-old, comprises a variety of stakeholders and professions and is worth trillions of dollars globally. It is also a fiercely complex and risky business, which is highly regulated, because of this, change and innovation can occur slowly. However, we are now in the 21st century, a century that has come to be defined by fast changing technology. What are the implications for the AEC industry?

DISRUPTION

Apple disrupted the music industry with an application called iTunes. Uber did the same to the taxi sector, Netflix to TV. A key aspect of these examples of innovation and disruption is that they all entered into a specific sector to be disruptive. Putting existing jobs at risk and circumventing regulations. In a sobering article by Daniel Davis (Davis 2019) it is clear the slow rate of change and innovation in the construction sector has not gone unnoticed. Venture capitalists and tech companies flush with money are circling the AEC sector.

Google has Sidewalk Labs ‘reimagining cities;’ Tesla has a power pack and makes photovoltaic roofing tiles; AirBnB have announced their intention to move more seriously into the architecture and construction area (Gebbia 2019; D’Onfro 2019; Oliver Milman 2016; Harrouk 2019). There are numerous start-ups. Katerra focusing on improving the organisation and management of building projects. WeWork are developing algorithms that are as good at designing office space as architects (Anderson et al. 2018).

Returning to our question, what are the implications for the AEC sector? It has become targeted by technology companies backed by wealthy venture capitalists. This is a cause for concern, for where these companies go disruption follows, and usually it does not favour existing stakeholders. Take for example Uber—while providing more convenience for service users—research suggests it creates less job security for drivers (Glöss, McGregor, and Brown 2016). The working condition of Amazon’s factory workers has also been questioned (Sainato 2019). So, although we often romanticise disruption it creates casualties. Those casualties are often the incumbent stakeholders in a sector, and when we talked about the AEC industry, we are referring to the existing contractors, sub-contractors, consultants, and even the owners.

THE FUTURE

This special issue represents work from researchers passionate, active and contributing to the future of construction. There is a very interesting analysis of productivity in the New Zealand construction industry (Adafin and Wilkinson). It delineates several key productivity improvements that could result from adopting digital technologies, and identifies barriers and benefits to each. Another paper reports on work developing methodologies and technologies for simplifying and streamlining change requests in BIM (Dawood and Dawood). It explores the concept of visualising IFC models and using natural language processing (NLP)—plain English, in layman’s terms—to query the digital model. This would remove significant technical barriers, enabling people with a non-technical background to access and understand this complex information. Two papers specifically look at Level of Detail (LOD) in BIM and discuss different approaches. First, the use of LOD in heritage building rehabilitation

has offered unexpected benefits (Graham et. al.). Areas of a model with higher level of fidelity can quickly be identified as areas of high heritage and cultural value in both BIM models when translated to virtual reality (VR) environments. Second, researchers are applying neural networks to LOD (Hong et. al). Taking some of the guesswork out of BIM implementation by using a neural network to predict the LOD which will provide the best cost-benefit to any given organisation. Neural networks are also featured in a paper exploring how they might be applied to recognising features in construction site photos (Nath et. al). Photos are becoming increasingly important in management and communication during construction. Yet labelling and filing is highly labour intensive; each photo has to be manually opened and appraised by a person. Elsewhere researchers report on robotics and the concept of 'platform economy' (McMeel). An integrated design, fabrication and robotic assembly platform is prototyped; it demonstrates how these disparate parts of construction could be streamlined and what the wider implications for the construction sector may be.

In summary the editors of this special issue do not wish to understate the enormity of the challenges facing the AEC sector. Nor do we claim all the answers are to be found in this issue at all. Rather, it represents a fraction of the projects and people that are working to redefine what the new 'reality' is for construction and a small effort to contribute towards what the avenue of innovation and change might be in the 21st century. A century that has already seen its share of sectors fall casualty to disruption.

REFERENCES

- Anderson, Carl, Carlo Bailey, Andrew Heumann, and Daniel Davis (2018). "Augmented Space Planning: Using Procedural Generation to Automate Desk Layouts." *International Journal of Architectural Computing* 16 (2): 164–77. <https://doi.org/10.1177/1478077118778586>.
- D'Onfro, Jillian (2019). "Google Sibling Sidewalk Labs Unveils 'Smart City' Plans For Toronto Waterfront." *Forbes*, 2019.
- Davis, Daniel (2019). "Here Come Big Tech and the Venture Capitalists." *Architect: The Journal of the American Institute of Architects*. 2019.
- Gebbia, Joe (2019). "Introducing Samara: A Look inside Our New in-House Design Studio." *AirBnB*. 2019.
- Glöss, Mareike, Moira McGregor, and Barry Brown (2016). "Designing for Labour: Uber and the on-Demand Mobile Workforce." In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 1632–43. ACM.
- Harrouk, Christele (2019). "Airbnb Ventures into House Design." *ArchDaily*. 2019. <https://www.archdaily.com/923769/airbnb-ventures-in-the-conception-of-houses>.
- Oliver Milman (2016). "Elon Musk Leads Tesla Effort to Build House Roofs Entirely out of Solar Panels." *The Guardian*, 2016. <https://www.theguardian.com/technology/2016/aug/19/elon-musk-tesla-solar-panel-roofs-solarcity>.
- Sainato, Michael (2019). "Revealed: Amazon Touts High Wages While Ignoring Issues in Its Warehouses." *The Guardian*, 2019.